influence of the electrical stress, likewise flew off, and were deposited in the metallic state near the pole.

An experiment was tried to discover if the ions of metal, deposited in this manner on a metal plate connected with an idle pole, in the full stream of + ions and – electrons, showed any special + or – electrification. In all cases the electrification was positive. This lends support to Mr. Strutt's view that + ions as well as – electrons will fly off from a radio-active body. Even these results, however, must not be taken as conclusive, for in a paper published in 1891,* I showed that at a high vacuum nearly the whole of the interior of a tube through which an induction spark was passing was electrified positively, negative electrification being detected only in the immediate neighbourhood of the negative pole.

During the course of my experiments a curious circumstance was observed, which deserves record as it may elucidate some of these obscure phenomena. While the volatilisation of the silver pole is rapidly proceeding, the metal glows as if red-hot. This "red heat" is superficial only. The metal instantly assumes, or loses, the appearance of red heat the moment the current is turned on or off, showing that the high temperature does not penetrate below the surface. The volatilisation of the positive ions is confined to the surface, and the surface glow is connected with that action. If instead of silver, a good conductor of heat, I take diamond, a bad conductor, the surface layers are changed sufficiently to convert them into a form of graphite, which from its great resistance to oxidising agents, cannot be formed at a lower temperature than 3600° C.

"The Density and Coefficient of Cubical Expansion of Ice." By J. H. VINCENT, D.Sc., B.A., St. John's College, Cambridge. Communicated by Professor J. J. THOMSON, F.R.S. Received January 22,—Read February 6, 1902.

(Abstract.)

After an account of the methods employed by previous experimenters in the subject, reference is made to the views of Nichols, according to which two distinct kinds of ice have been subjected to experiments. The density of artificial ice is about 0·916 gramme per cubic centimetre, while that of natural ice is more than one part in a thousand greater.

* "Electricity in Transitu: from Plenum to Vacuum," 'Journ. Inst. Elect. Engin.,' vol. 20, p. 10.

Two tables are given showing in the first all the results which have been published concerning the density and coefficient of cubical expansion of ice, and in the second the same results tabulated separately according to the variety of ice used. The mean result for the density of natural ice at freezing point is 0·9176, while that of artificial ice is 0·9162 gramme per cubic centimetre. Only one estimation of the dilatation of natural ice is available. It is 0·0001125 for the cubical coefficient per degree C. The mean of three available results for artificial ice is 0·000160.

It was thought desirable to use a method of experiment which would yield a result both for the density and for the coefficient of cubical expansion, and in order that the work should have any value it was necessary to employ some device other than any which had been used previously.

The method consisted in weighing a quantity of water in mercury. The water was weighed both as liquid at 0° C., and as solid at several temperatures below freezing point. If we assume values for the density of water and mercury at 0° C., the density of ice at 0° C. can then be calculated, if we also assume that the densities of ice and mercury are linear functions of the temperature. The coefficient of cubical expansion of ice can also be calculated from these results, but it will depend on the law assumed for the contraction of mercury, and upon the accuracy of the thermometry.

Instead of using a sinker to keep the vessel containing the water or ice under the surface of the mercury, a modification of Joly's Hydrostatic Balance was employed.*

Ten values of the density of ice at different temperatures below 0° C. were obtained in this way. The specimens of water were four in number, and the temperatures ranged from $-10^\circ{\cdot}02$ to $-0^\circ{\cdot}37$ C. The whole of the weighings taken with the final form of apparatus are included in these determinations.

In one experiment the values obtained show unmistakably that the same specimen of water may assume different densities on freezing.

The ten values of the density are set out as functions of the temperature on a chart, and a graphical method is used to extrapolate for five values of the density of 0° C. These five values have weights assigned to them proportional to the number of separate determinasions of the density from which they are derived. The numbers thus obtained and the weights to be assigned to them are set out in the following table.

* Joly, 'Phil. Mag.,' September, 1888.

Experiment.	Density at 0° C.	Weight assigned.
1	0·916335	3
2	0·915460	2
3	0·916180	2
4	0·915540	1
	0·916060	2
Weighted mean...	0·9160	

We thus obtain 0·9160 gramme per cubic centimetre as the density of ice at 0° C.

Four values for the coefficient of cubical expansion can be obtained from these results. They are :—

Experiment.	Coefficient of cubical expansion.
1	0·000155
2	0·000152
3	0·000153
4	0·000148
Mean	0·000152

The results of this investigation are that Nichols' value for the density of artificial ice is confirmed, but that since the same specimen of water can freeze into specimens of ice having different density, the use of the Bunsen ice calorimeter in absolute determinations must be limited to an accuracy of probably one in a thousand.

The expenses of this research have been in part defrayed by a Government grant from the Royal Society, and in part by the Cavendish Laboratory.

I wish to thank Professor J. J. Thomson, F.R.S., for his kind encouragement, and my thanks are also due to Mr. E. H. Griffiths, F.R.S., through whom I was led to undertake the investigation.